

NASA Office of Technology Transfer

John C. Stennis Space Center

NASA Helps Industry Relieve Pressure – Safely

A high-performance pressure relief valve (PRV95) now being manufactured provides the answer to premature wear and instability.



PRV95 10000-PSI



PRV95FA – RELIEF

Developed by Marotta Scientific Controls, Inc., of Montville, NJ, under a Small Business Innovation Research Agreement with the NASA Office of Technology Transfer at Stennis Space Center the high-performance pressure relief valve (PRV95) provides stability over an entire operational range, from fully closed to fully open. The valve employs upstream control for valve positioning while exhibiting good repeatability with minimal lag time.

In many industrial applications, pressure relief valves (PRV) perform a critical function; the safe release of pressure before potentially damaging build-ups occur. Conventional relief valves have proven unstable, leading to premature wear with potentially devastating consequences. A high-performance pressure relief valve now being manufactured by Marotta Scientific Controls, Inc., of Montville, NJ, provides the answer to premature wear and instability. Using an improved valve design developed through the Small Business Innovation Research Program (SBIR), Marotta's PRV95 provides stability over an entire operational range, from fully closed to fully open. The valve employs upstream control for valve positioning, making the valve more stable and exhibiting good repeatability and minimal lag time.

HOT Points

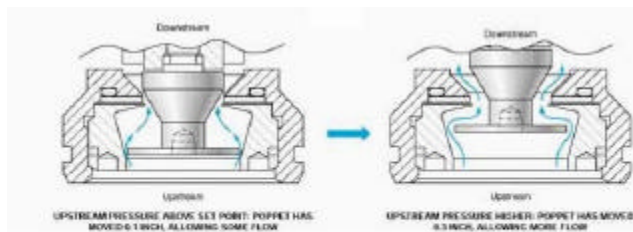
- **High performance pressure relief valve.**
- **Provides increased stability over the entire operational range.**
- **Operates under Upstream control for valve positioning.**
- **Reduces risk of product fire and explosion through elimination of "Hard Impact".**
- **Reduces uncontrolled venting of hazardous fluids and products.**

“ It opens and closes softly, and does not oscillate or generate hard impacts; oscillation can result in a hard impact pressure release, which can lead to an explosion in the presence of oxygen,” says Bill St. Cyr, Chief of Test Technology Branch at Stennis Space Center.

Marotta's PRV95 design is also unique in its ability to maintain a seal near the set point of the relief limit. Typically, relief valves seal tightly up to 90% of set point and then reseal when pressure is reduced to 85% of set point. The PRV95 technology maintains seal integrity until 98% of set point and will reseal a 95-97% of set point. This allows the operator to protect his system while not exceeding its limits.

HOW PRV95 WORKS

The key to stable, soft-opening/soft-closing operation is upstream control. A conventional “pop”-type pressure relief valve is characterized as operating under downstream control. Once the valve has opened, the flow is controlled mainly by an effective cross-sectional area downstream of the valve seat. In the PRV95 the flow-limiting cross section remains upstream of the valve seat at all times, and so the valve is said to operate under upstream control.



The figure illustrates the basic design and principle of operation of an improved valve.

As in a conventional relief valve, excessive upstream pressure opens the valve by lifting a poppet from a seat in a valve body. However, the poppet in the PRV95 includes a conical portion and a paddle (essentially a disk) upstream of the conical portion. When the valve is closed and the upstream pressure is below the set point, the conical portion of the poppet engages about half the thickness of a main valve seat, forming a tight seal. In this condition, the paddle engages the wall of a cylindrical passage upstream of the main valve seat. When the upstream pressure rises to approximately the set point, the poppet moves downstream a little, but the valve is not yet open; the conical portion of the poppet remains partly engaged with the main valve seat, while the paddle remains in the cylindrical passage in the retainer. As pressure rises above the set point, the conical portion of the poppet moves out of the main valve seat and the paddle moves out of the cylindrical passage in the retainer.

BENEFITS TO INDUSTRY

Primarily designed to operate in systems that contain gases and liquids in a variety of pneumatic, hydraulic, and cryogenic applications, the PRV95 offers several advantages

over valves with different operating characteristics: (1) a smooth transition from fully closed to fully open, (2) noise and wear reduction through elimination of chatter, (3) reduction in the risk of fire and explosion through elimination of hard impact, and (4) corresponding reductions in the uncontrolled venting of hazardous fluids. In summary, the increased stability of the valve operation results in better performance, with wider operating ranges and control. All of these items translate to the additional advantage of lower life-cycle costs.

WHAT IS THE FUTURE

To date, sales of the PRV95 total over \$400,000.00 mostly to high-end customers including the U.S. Navy on its DDG-51 Class Destroyer. “Additional commercial sales are now required in order to be anything other than a specialty player in the relief valve market. Our relief valve is not meant to be used everywhere, its features aren’t always required. But where a traditional valve fails and the media is expensive or volatile, our design is vastly superior,” says Patrick Marotta, Commercial Products Manager at Marotta. To this end, Marotta is pursuing two avenues. First is a valve redesign effort to improve manufacturability to reduce the high price of the product. The second initiative is to obtain ASME Section VII certification. Marotta Scientific and the Office of Technology Transfer at John C. Stennis Space Center have entered into a Dual-Use Cooperative Agreement to develop an ASME Section VII certified PRV95 that meets the special pressure and compatibility requirements at SSC.

WHY SBIR WAS IMPORTANT

“The SBIR program enabled us to research, develop, and commercialize this technology through a combination of development funds and Marotta Scientific’s own investment,” said Marotta. “Right now a follow-on agreement that will enhance our technology and address a government need is being completed.”

The SBIR Program is a highly competitive multi-phase program that provides small U.S. businesses with federal funds reserved for conducting serious research and development. The program at Stennis Space Center is managed through the Office of Technology Transfer; for more information regarding the NASA Small Business Innovation Research Program contact the Office of Technology Transfer at Stennis Space Center.

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